

ELECTRONIC FUNDAMENTALS

SERVICE PRACTICES 16

HOW TO USE CATALOGS AND SERVICE DATA

- 16-1. Radio-Service-Data Sheets
- 16-2. Commercial Service Data And Service Notes
- 16-3. Record-Changer Service Manuals
- 16-4. Auto-Radio Data Sheets and Manuals
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RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION OF AMERICA
HOME STUDY SCHOOL
350 West 4th Street, New York 14, N. Y.

Service Practices 16

INTRODUCTION

In this lesson you will learn how to obtain and use the printed data and information supplied by manufacturers of radio and television receivers and electronics publishers. The information you can get from this printed matter will help you in your service work.

The types of published information discussed in this lesson are:

1. Radio-service-data sheets printed by radio and television manufacturers
2. Commercial radio manuals
3. Auto-radio-data sheets and manuals
4. Automatic-record-changer service manuals
5. Actual case-history books
6. Tube substitution and tube replacement guide books
7. Dial-cord stringing-guide booklets
8. Parts-replacement guide books
9. Master catalogs and official buying guides
10. Mail-order advertisement sheets

16-1. RADIO-SERVICE-DATA SHEETS

Use. Radio-service-data sheets, also known as radio-service notes, are published by radio manufacturers. These sheets are usually 8½ inches x 11 inches and may be kept in a standard loose-leaf binder.

It is not necessary to obtain service notes or data for all types of radio repairs. How-

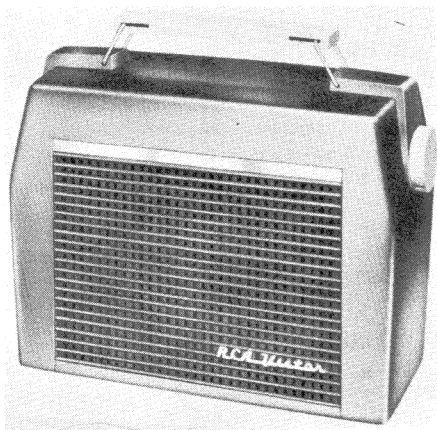
ever, when you are not too sure about how to make a repair or when extra information is needed, service notes and data become valuable. When it becomes necessary to replace a defective part with a new one, the service data sheet gives all of the information so that the new part may be correctly ordered.

Figures 16-1 *a*, *b*, *c*, and *d* show typical radio-service data for a portable radio receiver manufactured in 1953. All of the information needed to identify the model and type of radio set is placed at the top of the front page, as shown in Fig. 16-1*a*. There is a photograph of the receiver, a list of the different cabinet colors, and the identifying name, "The Yachtsman". You can see that the receiver may be operated on either a.c., d.c., or batteries. The year this model was made by RCA is 1953. The model or series and the chassis number are given.

Below the heading is the *Specifications* column. This gives important detailed information. For example, by looking at this column you can see that the tuning range of the set is from 540 to 1600 kc, which means that only the standard broadcast stations are received. The intermediate frequency is shown to be 455 kc. You must know this if you realign the receiver. The power-line information gives the required voltage and frequency at the electrical-socket outlet and shows that the normal power consumption is 18 watts.

Then there is a list of the information needed for replacing the batteries, tubes, and the selenium rectifier.

In the right-hand column, information is given about the loudspeaker. The size and voice-coil impedance of a replacement loudspeaker must be the same as shown in the data sheet, and the speaker must fit the same chassis holes as the original speaker. Usual-

**THE YACHTSMAN**3-BX-51
Brown3-BX-52
Tan3-BX-53
Green3-BX-54
Red**RCA VICTOR**

AC-DC-Battery Portable Receiver

3-BX-51 SERIES

Chassis No. RC-1126

SERVICE DATA

— 1953 No. 3 —

PREPARED BY RCA SERVICE CO., INC.
FOR**RADIO CORPORATION OF AMERICA**

RCA VICTOR DIVISION

CAMDEN, N. J., U. S. A.

Specifications

Tuning Range 540-1,600 kc
 Intermediate Frequency 455 kc
 Power Supply Rating
 Power Line Operation
 115 volts, d. c. or 50 to 60 cycles a. c. 18 watts
 or
 Battery Operated using RCA VS 050 Battery
 (Average battery life — 100 hrs. intermittent service)
 Battery current "A" 50 ma., "B" 13 ma.
 Battery voltage "A" 7½ volts, "B" 75 volts

Tube Complement

- (1) RCA 1R5 Converter
 (2) RCA 1T4 I.F.-Amplifier
 (3) RCA 1U5 Det. — AVC — 1st A.F.
 (4) RCA 3V4 Output
 RCA Stock No. 77958 Selenium Rectifier

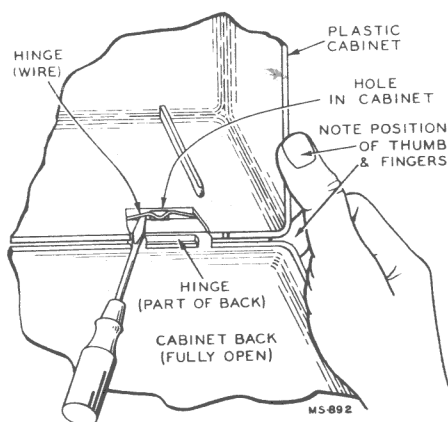
Loudspeaker
 Size and Type 4 in. P.M.
 Voice Coil impedance 3.2 ohms at 400 cycles

Power Output
 Undistorted 0.19 watt
 Maximum 0.32 watt

Tuning Drive Ratio 1:1 (Direct Drive)

Weight (Approx.)
 Without battery 5 lb. With battery 8 lb. 2 oz.

Cabinet Dimensions
 Height 8¾ in. Width 12 in. Depth 5 in.



Removal of Cabinet Back

To Remove Cabinet Back

With the back fully open, grip the cabinet as illustrated. Insert a screwdriver under one hinge and pry the center of the hinge out of the opening in the cabinet while maintaining pressure on the back with the fingers and on the cabinet with the thumb. Repeat this procedure with the other hinge. Pull the back straight to the rear using both hands.

To Remove Hinges

Remove back from cabinet as described above. Spread the hinge apart to remove it from the cabinet back.

To Remove Chassis:

1. Pull out battery and disconnect battery plug.
2. Unsolder the two loop antenna leads.
3. Remove pull-off type volume and tuning knobs.
4. Remove the two large screws in the top of the case near the volume and tuning control shafts.

(a)

Fig. 16-1

3-BX-51 Series

Alignment Procedure

Output Meter Alignment—If this method is used, connect the meter across the voice coil and turn the receiver volume control to maximum.

Test Oscillator—For all alignment operations, connect the low side of the test oscillator to the receiver chassis and keep the oscillator output as low as possible to avoid AVC action.

Battery operation of the receiver is preferable during alignment; on AC operation, an isolation transformer (117v./117v.) may be necessary for the receiver if the test oscillator is also AC operated.

Step	Connect High Side of Sig. Gen. to —	Sig. Gen. Output	Dial Pointer Setting	Adjust for Max. Output
1	Disconnect loop—remove chassis—remove bottom plate.			
2	Connect a 10,000 ohm resistor in parallel with r. f. tuning cond. C1B.			
3	Pin #6 of 1T4 I.F. Amplifier thru 0.01 mf.	455 kc	Quiet point near 1600 kc	2nd I.F. Trans. T2 Top
4	Pin #6 of 1R5 Converter thru 0.01 mf.			1st I.F. Trans. T1 Top & Bottom
5	Replace bottom cover and install chassis in cabinet. Re-connect loop.			
6	Short wire placed near loop for radiated signal	1620 kc	min. cap.	1620 kc osc. trimmer C1A-T
7		1400 kc	1400 kc Signal	1400 kc ant. trimmer* C1B-T
8		600 kc	600 kc Signal	T4 osc. core* while rocking gang
9		Remove the 10,000 ohm resistor from r.f. tuning cond. C1-B.		
10	Repeat Steps 6, 7, 8 and 9.			

* The position of the battery affects loop inductance. The battery should be in place during steps 6 to 10.

Critical Lead Dress

1. Dress antenna leads away from trimmer adjustment.
2. Dress capacitors down against chassis where possible.
3. Dress output transformer primary leads against chassis.
4. Dress power cord leads away from selenium rectifier and audio connections.
5. Dress leads and components away from bleeder resistor.
6. Dress C2 away from gang towards front apron to permit rotor plates of gang to open fully without interference.

Circuit Description

The model 3BX51 is a portable radio receiver designed to operate from a 105-125 volt A.C. or D.C. power source, as well as a self contained battery pack. The receiver contains four miniature tubes plus a selenium rectifier, and covers the Standard Broadcast range of 540 to 1600 Kcs.

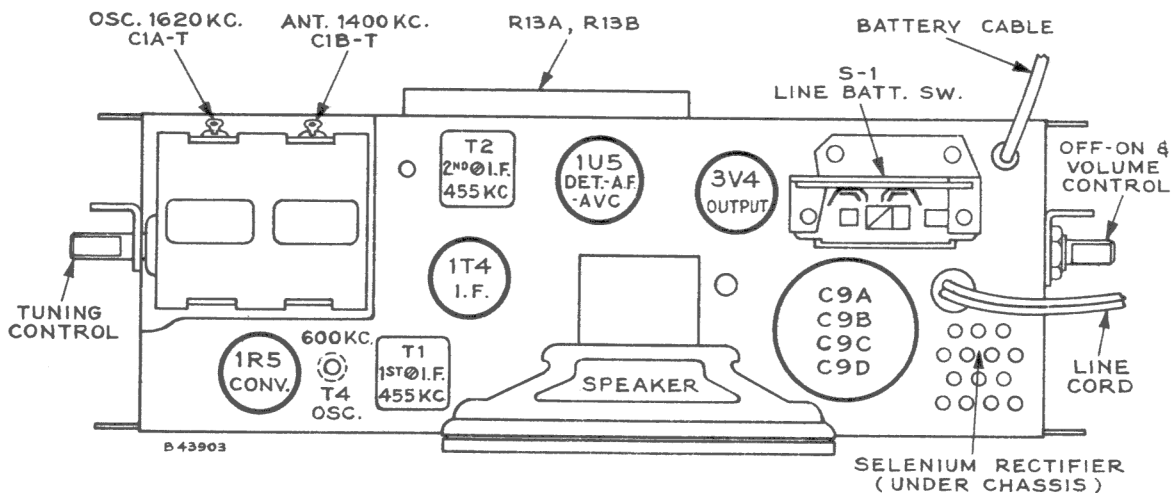
The case for this instrument is molded polystyrene. The dial is incorporated into a highly styled tuning knob. The gang is direct driven by this tuning knob and is on the right-hand-side of the cabinet. The ON-OFF, volume control knob is on the left side of the cabinet.

The receiver circuit is a superheterodyne, using a pentagrid converter, a double-tuned first I.F. transformer, pentode I.F. amplifier, a second I.F. transformer with one tuned, and one untuned circuit, a combined second detector, AVC and first audio tube, and a power output tube. When the receiver is connected to an A.C. power line, a conventional half-wave rectifier is used to provide operating power.

Tuning of the signal circuits is accomplished by means of a variable capacitor, direct driven by a tuning knob. A cut-plate oscillator section is employed to provide tracking. The antenna is a built-in loop, insulated with celanese acetate spiral-wound and mounted on the back cover.

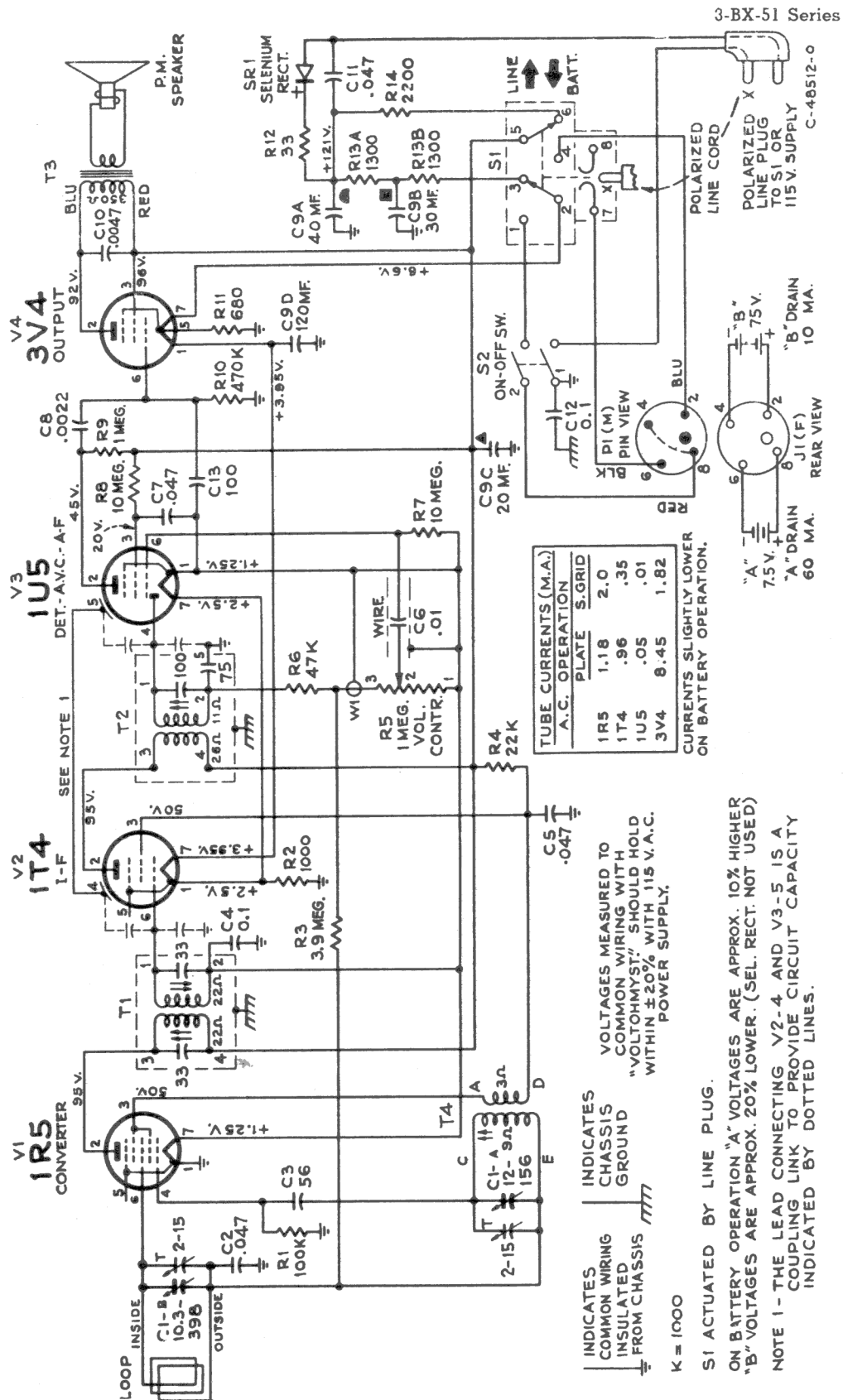
CAUTION—

Do not remove any tubes from the chassis with the set operating and the plug connected to the power line. Damage to tubes may result.



(b)

Fig. 16-1 (continued)



(c)
 Fig. 16-1 (continued)

Schematic Diagram—Chassis No. RC-1126

3-BX-51 Series

Replacement Parts

STOCK No.	DESCRIPTION	STOCK No.	DESCRIPTION
CHASSIS ASSEMBLIES RC-1126		74775	Transformer—2nd. I.F. transformer complete with adjustable core (T2)
77957	Capacitor—Variable tuning capacitor (C1A, C1B)	74779	Transformer—Output transformer (T3)
75784	Capacitor—Fixed, ceramic, non-insulated, High "K":— 56 mmf., $\pm 20\%$, 500 volts DC (C3)	SPEAKER ASSEMBLIES	
	Capacitor—Fixed, mica:—	971495-8	
39628	100 mmf., 500 volts DC (C13)		
	Capacitor—Electrolytic:—		
77956	comprising: 2 sections of 40 mfd., 150 volts, 1 section of 30 mfd., 150 volts and 1 section of 120 mfd., 25 volts. (C9A, C9B, C9C, C9D)	77959	Speaker—4" P.M. speaker complete with cone and voice coil (32 ohms)
	Capacitor—Fixed, paper, moulded:—	MISCELLANEOUS	
75071	.047 mfd., 400 volts (C11)	74789	Antenna—Antenna loop winding only
	Capacitor—Fixed, tubular, paper:—	77967	Back—Case back—brown—complete with loop less front assembly for Model 3BX51
73595	.0022 mfd., 600 volts (C8)	78017	Back—Case back—tan—complete with loop less front assembly for Model 3BX52
73920	.0047 mfd., 600 volts (C10)	78019	Back—Case back—green—complete with loop less front assembly for Model 3BX53
73561	.01 mfd., 400 volts (C6)	78021	Back—Case back—red—complete with loop less front assembly for Model 3BX54
73553	.047 mfd., 400 volts (C2, C5, C7)	74787	Board—Terminal board for antenna loop
73551	0.1 mfd., 400 volts (C4, C12)	77966	Case—Case front—brown—complete with "RCA Victor" emblem less handle, links and back for Model 3BX51
73935	Clip—Mounting clip for I.F. transformer	78016	Case—Case front—tan—complete with "RCA Victor" emblem less handle, links and back for Model 3BX52
74405	Coil—Oscillator coil complete with adjustable core (T4)	78018	Case—Case front—green—complete with "RCA Victor" emblem less handle, links and back for Model 3BX53
38904	Connector—2 contact female connector for A.C. line cord	78020	Case—Case front—red—complete with "RCA Victor" emblem less handle, links and back for Model 3BX54
73275	Connector—5 contact male connector for battery cable	77964	Dial—Tuning dial knob—tan—for Model 3BX51
74285	Control—Volume control and power switch (R5, S2)	78011	Dial—Tuning knob dial—brown—for Model 3BX52
70022	Cord—Power cord and plug	78013	Dial—Tuning dial knob—gray—for Model 3BX53
74838	Grommet—Power cord strain relief (1 set)	78015	Dial—Tuning dial knob—red—for Model 3BX54
72283	Grommet—Rubber grommet for mounting variable capacitor	77012	Emblem—"RCA Victor" emblem
18469	Plate—Mounting plate for electrolytic	77962	Handle—Carrying handle—tan—for Model 3BX51
77958	Rectifier—Selenium rectifier (SR1)	78007	Handle—Carrying handle—brown—for Model 3BX52
	Resistor—Wire wound:—	78008	Handle—Carrying handle—gray—for Model 3BX53
74777	dual 1300 ohms, 3.5 watts (R13A, R13B)	78009	Handle—Carrying handle—red—for Model 3BX54
	Resistor—Fixed, composition:—	74790	Hinge—Cabinet back hinge
513033	33 ohms, $\pm 10\%$, 1 watt (R12)	77963	Knob—Volume control and power switch knob—tan—for Model 3BX51
503168	680 ohms, $\pm 10\%$, $\frac{1}{2}$ watt (R11)	78010	Knob—Volume control and power switch knob—brown—for Model 3BX52
503210	1000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt (R2)	78012	Knob—Volume control and power switch knob—gray—for Model 3BX53
503222	2200 ohms, $\pm 10\%$, $\frac{1}{2}$ watt (R14)	78014	Knob—Volume control and power switch knob—red—for Model 3BX54
503322	22,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt (R4)	77961	Link—Carrying handle link (2 req'd)
503347	47,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt (R6)	73203	Nut—Speed nut to fasten decorative strip or "RCA Victor" emblem to cabinet
503410	100,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt (R1)	74734	Spring—Spring clip for knobs
503447	470,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt (R10)	77960	Strip—Decorative metal strip (gold finish)
503510	1 megohm, $\pm 10\%$, $\frac{1}{2}$ watt (R9)		
503539	3.9 megohm, $\pm 10\%$, $\frac{1}{2}$ watt (R3)		
503610	10 megohm, $\pm 10\%$, $\frac{1}{2}$ watt (R7, R8)		
73103	Shield—Tube shield		
73117	Socket—Tube socket, 7 contact, miniature, wafer		
71039	Switch—Battery switch (S1)		
73129	Transformer—1st. I.F. transformer complete with adjustable core (T1)		

APPLY TO YOUR RCA DISTRIBUTOR FOR PRICES OF REPLACEMENT PARTS

(d)

Fig. 16-1 (continued)

ly, it is best to order replacement parts from the manufacturer of the receiver, if you are in doubt whether other manufacturers' parts will fit. Later in this lesson, you will learn how to order original parts or parts made by other manufacturers.

The information given about the power output tells you how much sound power the radio will deliver. The tuning drive ratio is given as 1:1 (direct drive). This shows that a dial cord or string is not used but that the tuning knob shaft is directly coupled to the tuning capacitor. The weight and cabinet dimension information is very useful if it becomes necessary to mail or ship the radio receiver.

At the end of the page are instructions for properly removing the cabinet back and hinges, and the radio chassis. Knowing how to do this correctly will prevent damage or breakage to the cabinet. The illustration to the left shows how the back of the cabinet is removed.

At the top of the second page of the data sheet (Fig. 16-1b), the alignment procedure is given. This explains how to connect up both the output meter and the test oscillator. Then, ten steps are given for the complete alignment procedure. The illustration at the bottom of the page shows all tube and trimmer adjustment locations. (In lessons to follow, you will learn how to make such alignments.)

In the upper right-hand column, instructions are given for critical lead dress. This means that certain parts and wires should be placed in positions that will allow for the best operation of the receiver. The circuit description that follows contains useful technical information about the electrical circuit and the operation of the set.

On the third page of the data sheet, shown in Fig. 16-1c, is a complete schematic diagram of the receiver. The values of all resistors and capacitors are shown. The d-c resistance of tuning coils and transformers given in the schematic will help you to make resistance measurements with an ohmmeter.

The schematic shows the correct d-c voltages to be expected at different points in the circuit. These voltage values are shown at the tube pin numbers. For example, a d-c potential of 95 volts normally should be measured between pin 2 of the 1R5 tube (V_1) and the common wiring insulated from the chassis. (A common wiring point is any lead going to the symbol $\equiv$.) In many a.c.-d.c. receivers, this is *not* chassis ground. In such sets circuits going to or connected to chassis ground are shown going to the symbol marked /// .) Another example shows that a d-c voltage of 1.25 volts is normally measured from pin 1 of the 1U5 tube (V_3) to any common point $\equiv$.

The last page of the data sheet (Fig. 16-1d) gives a complete list of replacement parts. This includes the manufacturer's stock number and a description of each part. Enough information is given so that any replacement part may be ordered directly from the radio manufacturer. Enough information is given to enable you to purchase many of the parts elsewhere.

How to Obtain Data Sheets from Manufacturers. The best way to obtain data sheets or service notes is to get them directly from the radio manufacturer or from the company that distributes that brand of radio receiver. If you cannot go to the manufacturer or distributor, write him giving all of the information necessary so that the correct data sheet may be sent. This information is usually found on the inside of the radio receiver. Look for a series number, model number, and identifying name and year. Also, request and price of the data sheet, as most manufacturers charge for them. If the set is too old, the manufacturer or radio distributor may not have the data sheet for it in stock. For example, some manufacturers keep certain data sheets in stock for only one year; other manufacturers may keep certain sheets in stock for five years or longer.

16-2. COMMERCIAL SERVICE DATA AND SERVICE NOTES

Types. When a radio manufacturer or distributor no longer keeps service data sheets or service notes in stock due to the age of

the receiver, publishers who specialize in printing radio servicing information take over. It is possible to buy these data sheets and service notes directly from these publishers. These sheets can be bought either separately, such as the four-page data sheet shown in Fig. 16-1, or they can be bought in book form. If you buy a book, the book will consist of many different data sheets, each containing information for a different model of radio receiver. These books can be obtained either in expensive, hard-cover manual form, with thousands of pages in each manual (for example, 15 of these volumes contain over 20,000 pages showing 12,000 chassis and 40,000 different models of radio receivers), or in inexpensive soft-cover book form. A complete set of hard-cover manuals costs hundreds of dollars when all volumes are purchased and is usually owned by large, busy radio-repair shops. Each of these manuals may be bought separately, if desired.

The smaller books also contain quantities of data sheets each giving data for a different model receiver. Some of these books contain data for receivers made by only one manufacturer; others have mixed diagrams and service notes for receivers made by many different radio manufacturers, including both the late models and older models. For example, it is possible to buy a soft-cover radio manual that contains diagrams and service data for eight RCA radio receivers that were made between June 1951 and December 1953. It is also possible, for example, to obtain diagrams and data sheets in soft-cover book form for ten different make radio sets, all made between June 1951 and December of 1953. Other soft-cover manuals show radio data for receivers that were made as far back as 1940 and earlier. The price varies with each of these books, depending upon the publisher and the amount of data in each book.

Reading and understanding the service data in these books is the same as explained for the separate service data sheets as shown in Fig. 16-1. The specifications and other information differ for each type of receiver. For example, if the set receives FM and AM signals, information is given in the data sheets for the alignment of the FM

section as well as the AM section. Figure 16-2 shows a portion of a radio-data sheet taken from a soft-cover manual. Instructions for the alignment of both sections is given for a combination AM-FM receiver.

If the set is a radio-phonograph combination, the service data gives instructions for the operation and perhaps the adjustment of the record player. Figure 16-3a shows a portion of a data sheet taken from a soft-cover manual for an RCA radio-phonograph combination model 2US7. Instructions are given for the operation of the record player, but not for its repair and adjustment. Sometimes the same type of record changer is used in a different model radio-phonograph combination made by the same radio manufacturer. Possibly the repair and adjustment information can be found in the data sheet for that combination. For example, Fig. 16-3b shows part of a radio-data sheet taken from a soft-cover manual. This shows more complete information for the record player shown in Fig. 16-3a. Note that the RCA receiver model number is 2-S-10 but that the same type of record changer is used in both models. If you come across a situation like the one shown in Fig. 16-3a, thumb through your service notes until you find a more complete description, as in Fig. 16-3b.

If the radio-phonograph combination is an old model and service data for the record player cannot be gotten either in single data sheets or in the soft-cover manuals mentioned so far, special record-player manuals can be obtained from the manufacturers of record players.

How to Obtain Commercial Publishers' Data Sheets. During your career as a serviceman, you will need data sheets printed by commercial publishers. In order to save time and trouble, it is a good idea to know what type of material is available from these publishers. Therefore, as soon as you start in business as a serviceman, you should write to the publishers of radio-data sheets listed below and ask each firm for a free catalog of its radio-service-data publications. Then, when you need radio-service-data, refer to the catalogs in order to find what you want and who publishes it. Your radio and

PAGE 23-6 RADIO CORPORATION OF AMERICA

MODEL 1R81, Ch. RC1102, A, B, C

ALIGNMENT PROCEDURE—LEAD DRESS

Alignment Procedure

Due to the use of separate I.F. transformers, there is little interaction between the 10.7 mc. and the 455 kc. adjustments.

There is a slight interaction of adjustments on the tuning condenser between AM and FM.

If a large amount of adjustment is required of any circuit, all others should be checked in the following order:

- FM I.F.
- AM I.F.
- AM Osc., ant. and r.f.
- FM Osc., ant. and r.f.

Alignment Indicators:

For measuring the developed d-c voltage across C29 during FM alignment an RCA VoltOhmyst or an equivalent meter should be used. An output meter connected across the voice coil is also needed to indicate minimum audio output during FM Ratio Detector alignment.

The RCA VoltOhmyst can also be used to indicate audio output voltage across the voice coil or developed voltage on the AVC bus.

Signal Generator:

For alignment operations connect the low side of the signal generator to the receiver chassis. The output of the signal generator should always be controlled to prevent over-loading or excessive AVC action.

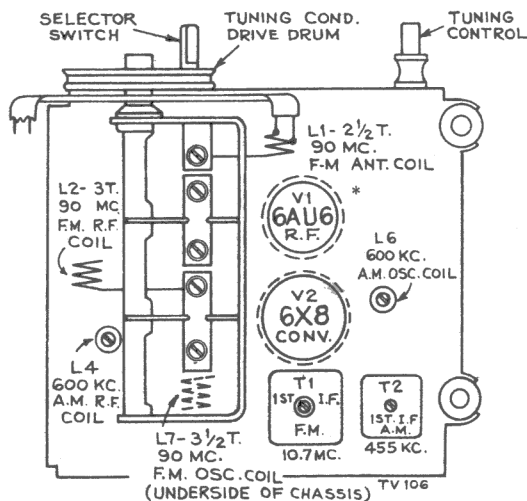
Oscilloscope Alignment:

It is preferable to use a sweep generator and oscilloscope for aligning I.F. and R.F. circuits to obtain a visual observation of curve shape during alignment.

With FM sweep generator connected between FM ant. (#3) terminal and chassis and oscilloscope connected between the junction of R28-C30 and chassis the overall FM response may be observed. There should be a peak to peak separation of not less than 180 kc. with 50,000 mv. input.

CRITICAL LEAD DRESS

1. Dress diode lead from second I. F. away from filament lead going to 6AV6 1st audio tube socket.
2. Lead from lug terminal "B" of the 1st FM transformer to rear switch wafer terminal #10 should not be changed from the original, 3 inches long plus or minus $\frac{1}{4}$ " of #22 copper vinylite covered.
3. A.C. leads from power switch on volume control should be dressed as far as possible from the audio-leads and audio coupling condensers near or connecting to the volume control terminals.
4. Ground straps between the R.F. shelf and the main chassis should not be relocated.
5. The connection point of capacitor C10 is critical, therefore should not be altered. It must be connected to the function switch and not to the I.F. transformer.



6AU6 is used as R.F. Amp. in RC-1102

6CB6 is used as R.F. Amp. in RC-1102A, RC-1102B, RC-1102C

FM Coil Locations

AM Alignment

RANGE SWITCH IN AM POSITION

Steps	Connect high side of sig. gen. to—	Sig. gen. output	Turn radio dial to—	Adjust for peak output
1	Pin 1 of V3 6BA6 in series with .01 mfd.	455 kc.	Quiet point at low freq. end.	T4 bottom core (pri.). T4 top core (sec.).
2	Pin 7 of V2 6X8 in series with .01 mfd.			T2 top core (sec.). T2 bottom core (pri.).
3	No. 1 terminal on ant. input strip	1620 kc.	High freq. end of dial (min. cap.)	C1-5T
4		1400 kc.	1400 kc. signal	C1-2T ant. C1-3T r.f.
5		Shunt a 10,000 ohm resistor across the r.f. section of the gang.		
6		600 kc.	600 kc. signal	L6 osc.* (Rock gang.)
7		Remove the 10,000 ohm resistor and peak L4 r.f.*		
8	Repeat 3, 4, 5, 6 and 7			

* The correct adjustment of the OSC. (L6) core is that peak obtained with core farthest away from the coil mounting clips. R.F. (L4) core should be set to the peak obtained (2 peaks are seldom obtainable) with core closest to the mounting clips.

FM Alignment

RANGE SWITCH IN FM POSITION — VOLUME CONTROL MAXIMUM

Steps	Connect high side of sig. gen. to—	Sig. gen. output	Turn radio dial to—	Adjust for peak output
1	Connect the d-c probe of a VoltOhmyst to the negative lead of the 2 mfd. capacitor C29 and the common lead to chassis.			
2	Pin 1 of V4 6AU6 in series with .01 mfd.	10.7 mc. modulated 30% 400 cycles AM	Quiet point at low freq. end.	T5 top core for max. d-c voltage across C29. T5 bottom core for min. audio output.*
3	Pin 1 of V3 6BA6 in series with .01 mfd.	Adjust to provide 3 to 4 volts indication on VoltOhmyst during alignment.		T3 top core (sec.). T3 bottom core (pri.).
4	Pin 7 of V2 6X8 in series with .01 mfd.			T4 top core (sec.). T4 bottom core (pri.).
5	#3 ant. term. in series with a 300 ohm resistor. (Remove ant. lead from #3 term.)	90 mc.	90 mc.	L7 osc.**
6		106 mc.	106 mc. signal	C1-1T ant. C1-4T r.f.
7		90 mc.	90 mc. signal	L1 ant.** L2 r.f.**
8	Repeat Steps 5, 6 and 7 until further adjustment does not improve calibration.			

* Two or more points may be found which lower the audio output. At the correct point the minimum audio output is approached rapidly and is much lower than at any incorrect point.

†† Alternate loading may be necessary to provide accurate observation of peaks.

Alternate loading involves the use of a 680 ohm resistor to load the plate winding while the grid winding of the SAME TRANSFORMER is being peaked. Then the grid winding is loaded with the resistor while the plate winding is peaked. Only one winding is loaded at any one time. Remove the 680 ohm resistor after T3 and T1 have been aligned.

Oscillator frequency is above signal frequency on both AM and FM.

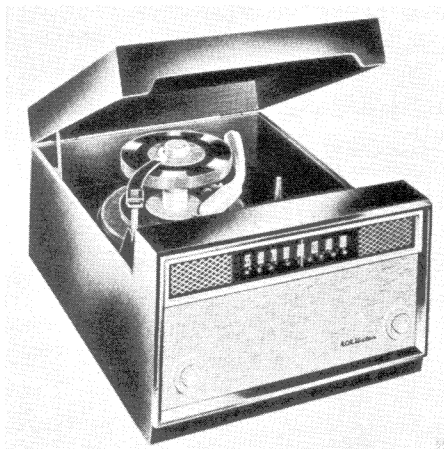
Extreme care should be used to avoid running the I.F. cores all the way through the winding and out the other end. Double peaks or serious overcoupling will result. The correct adjustment may be determined by starting the core all the way out (threads extended). The first peak obtained when tuning should be the correct peak.

** Note: FM antenna, mixer and oscillator coils are adjustable by increasing or decreasing the spacing between turns. The location of the tap on the antenna coil is $\frac{1}{4}$ turn $\pm$ $\frac{1}{4}$ turn from the ground end.

Fig. 16-2

RADIO CORPORATION OF AMERICA PAGE 23-65

MODEL 2US7,
Ch. RC1117A, C



SPECIFICATIONS

Tuning Range 540 - 1600 kc.

Intermediate Frequency 455 kc.

Tube Complement

- | | | |
|--------------|-------|-------------------------|
| 1. RCA 12BE6 | | Converter |
| 2. RCA 12BA6 | | I.F. Amplifier |
| 3. RCA 6AQ6 | | Detector—A.F. Amplifier |
| 4. RCA 6AQ6 | | Phase Inverter |
| 5. RCA 35CS | | } Push Pull Output |
| 6. RCA 35CS | | |
- A selenium rectifier Stock #76871 is used.

Power Supply Rating

1. 115 volts A.C., 60 cycles
(uses 930409-5 or -10 Changer) 45 watts
2. 115 volts A.C., 50 cycles
(uses 930409-11 Changer) 45 watts

Dial Lamps (2) Mazda type 51, 6-8 volts, 0.2 amp.

Loudspeaker

Size and type 5" x 7" P.M.
Voice coil impedance 3.2 ohms at 400 cycles

Power Output

Undistorted 2.0 watts
Maximum 2.4 watts

Cabinet Dimensions

Height 10" Width 16 3/4" Depth 20 3/4"

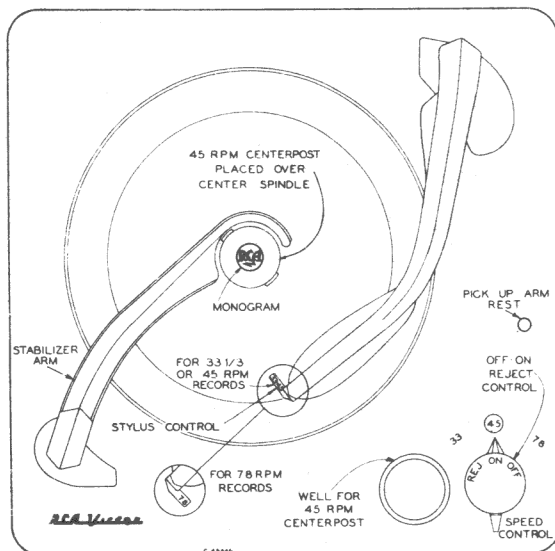
Tuning Drive Ratio 14 1/4:1 (7 1/8 turns of knob)

Record Changer (930409-5, -10 or -11)

Turntable speed 33 1/3, 45 or 78 r.p.m.
Record capacity up to fourteen 7 inch RCA type
or twelve 10 inch
or ten 12 inch
or ten 10 in. and 12 in. intermixed.

Pickup (Stock No. 75475) Crystal with replaceable styli.

Weight 26 lbs. net



Record Changer Controls

RECORD CHANGER CONTROLS

The record changer has a dual control on the motorboard and a stylus selector control on the pickup arm. The inner control (circular knob) is the OFF-ON-REJECT control. Turning this knob to the center position energizes the motor and starts the turntable, when turned to the right (clockwise) it starts the mechanism into complete automatic operation. The mechanism will shut off automatically after the last record has been played but can be shut off manually by turning this knob to the left (counter-clockwise).

The outer control (double ended lever) is the speed control. It has three normal positions, "33", "45", "78" to select the turntable speed desired and a neutral position (midway between "45" and "78"). The control should be turned to this neutral position if the changer is not expected to be in use for an extended period of time.

The stylus control has two normal positions (right and left) and one shipping position (lever pointing up). When playing 33 1/3 or 45 r.p.m. records the lever is turned so that "33-45" is visible on the TOP of the lever; likewise for 78 r.p.m. records "78" should be visible on the TOP.

The removable centerpost is for use with 45 r.p.m. records having the large centerhole. It must be placed over the center spindle with the "RCA" trademark monogram FACING to the FRONT. When not in use it is placed in a well at the front of the motorboard.

To load or remove records, the record stabilizer is lifted and turned off-side. After loading it is turned to the center where it rests on top of the stack of records.

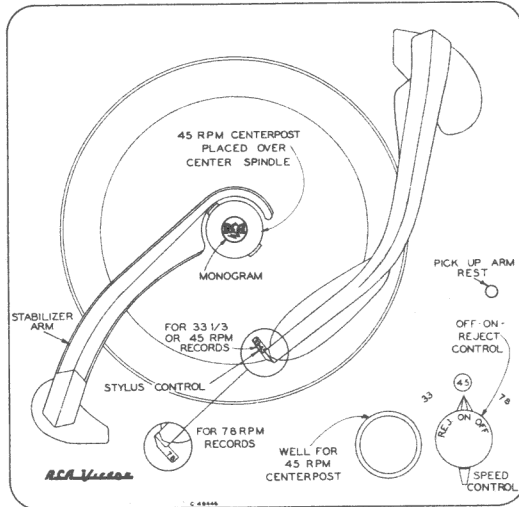
(a)

Fig. 16-3

PAGE 23-90 RADIO CORPORATION OF AMERICA

MODEL 2-S-10, Ch. RC1111

Record Changer



Controls

Record Changer Controls

The record changer has a dual control on the motorboard and a stylus selector control on the pickup arm. The inner control (circular knob) is the OFF-ON-REJECT control. Turning this knob to the center position energizes the motor and starts the turntable, when turned to the right (clockwise) it starts the mechanism into complete automatic operation. The mechanism will shut off automatically after the last record has been played but can be shut off manually by turning this knob to the left (counter-clockwise).

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To load or remove records, the record stabilizer is lifted and turned off-side. After loading it is turned to the center where it rests on top of the stack of records.

Record Changer Adjustments

Landing Adjustment

Only one landing adjustment is necessary. The landing position of the stylus is adjusted by means of the eccentric stud (20A), mounted on the pickup arm support bracket. When adjusted for correct landing on one side of record, the landing position for other sizes of records is automatically corrected.

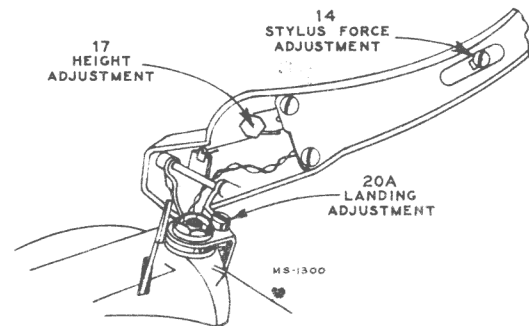
Pickup Arm Height Adjustment

The pickup arm height during cycle is adjusted by means of the hex head screw (17), located in the pickup arm.

Turn control knob to "REJ" and rotate turntable by hand until arm has risen to its maximum height. Adjust screw so that stylus is 1 3/8" above turntable.

Stylus Force Adjustment

Stylus force should be 7 1/2 to 9 1/2 grams. Loosen screw (14), and move slide until the correct force is obtained.



Adjustments

Tripping

The tripping method used in this mechanism is a velocity method. Velocity tripping is effective between 4 3/4" and 3 1/4" diameters, when the stylus moves inward 1/8" or more per revolution of the turntable. No adjustment is required.

Radio

Operating Instructions

RADIO—Turn extreme right hand FUNCTION knob to "AM" or "FM" radio position as desired. Turn OFF-VOLUME Knob "ON" and advance to mid-position for medium volume. Allow approximately 20 seconds for tube warm-up. With TUNING knob, select desired station indicated by dial pointer. Set tone controls for most pleasing reception. Turn BASS control counter-clockwise and TREBLE control clockwise for full tone. Adjust volume level as desired.

PHONOGRAPH—Turn extreme right hand FUNCTION knob to "PH" position. Turn OFF-VOLUME knob "ON" and advance to mid-position for medium volume. Set tone controls as indicated above for best tone. Refer to RECORD CHANGER section for operational information.

OFF - VOLUME BASS TREBLE TUNING PH-AM-FM



Radio Controls

Roll-Out Mechanism

Record Changer Mounting

The record-changer is mounted in a roll-out carriage. The changer mechanism is mounted on springs and should be free floating.

Roll-out Carriage Removal

Roll-out carriage has two stop pins, (one at the back end of each slide) held in place by retaining spring. To remove roll-out carriage, it is first necessary to pull the retaining springs out of the slides with a pair of long nose pliers, the stop pins are then easily removed. The roll-out carriage may then be removed from the front of the cabinet after disconnecting its connecting cables.

Roll-out Carriage Travel

The roll-out carriage has a normal movement limitation of approximately 10 inches. If it does not have this amount of movement, it may be due to an obstruction or from slippage or creeping of the balls of the slide mechanism. Travel restriction due to slippage or creeping of balls in the slide mechanism can be corrected by exerting slightly greater pull until the normal travel limitation is reached. The carriage should then operate to its full travel with normal pull.

(b)

Fig. 16-3 (continued)

television parts distributor will probably be able to supply you with the material you want. If he cannot, you can get what you need by writing directly to the publisher.

Publishers to whom you can write for free catalogs are as follows:

*John F. Rider, Inc.
116 West 14th Street
New York 11, New York*

*Howard W. Sams & Co., Inc.
2201 East 46th Street
Indianapolis 7, Indiana*

*Supreme Publications
1760 Balsam Road
Highland Park, Illinois*

16-3. RECORD-CHANGER SERVICE MANUALS

Record-changer manuals are printed by commercial publishers. They can be obtained in different volumes, each containing hundreds of pages of record-player information. The information given in some of these books is much more detailed than that given by the manufacturer on the original data sheet. The books are illustrated and give servicing hints based on actual work done on that equipment. There are parts lists of all parts used, and adjustment points are clearly shown in the photographs. Some record-changer manuals contain information for the repair and adjustment of wire recorders, tape recorders, and disc recorders going back to about 1947.

16-4. AUTO-RADIO DATA SHEETS AND MANUALS

The manufacturers of auto-radio receivers supply service data sheets for the use of the auto-radio installer and repairman. These data sheets are also known as *Service Manuals* or *Auto-Radio Bulletins*. A six-page radio-data service manual is shown in Fig. 16-4.

These data sheets usually can be obtained from the set manufacturer. When you write for the data sheet, be sure to give the name of the set and the model number. Most

manufacturers charge a small sum for these sheets, as explained before. If the manufacturer does not have these data sheets, try the radio-parts distributor. He may have auto-radio service manuals that contain notes on the receiver. These manuals contain service data information similar to the original manufacturers service-data sheets. The information is often arranged according to data of manufacture. For example, some manuals have information for auto sets made between 1946-1951, others for sets made between 1950 and 1954.

If there is no label on the set showing the name of the manufacturer, find out the name of the manufacturer of the automobile in which the auto-radio was installed. Send the model number of the set (stamped or printed on the set) along with the name of the automobile and the year that it was made, and ask for the service data sheets for the radio. If the automobile manufacturer does not have the service-data sheets, you may be able to find the information in commercial manuals. Some commercial manuals have auto-radio data sheets giving information about radios installed in automobiles made by one car manufacturer; other manuals have data sheets for radios installed in automobiles made by various manufacturers.

16-5. CASE HISTORIES

Books of short-cuts to repairing radios actually explain how certain radio receivers were repaired. Actual case histories give the name and model of the set, the complaint, the defects found, and how the trouble was corrected. Such books give case histories written in this manner:

"Case History No. 17: A Smith Radio Receiver, model 46-R, failed to operate. All resistances and voltages tested normal. An r-f signal-generator check to the grid of the 1T4 i-f amplifier tube resulted in no response. A check of i-f transformer T_2 showed that capacitor C_6 across the primary was open. The i-f transformer was replaced and the i-f stages were aligned to 455 kc. The set then operated normally."

Although you can learn to make repairs without referring to a book of this type (les-

Motorola[®] **AUTO** Radio

SERVICE MANUAL

**MODEL
NH1C**

GENERAL INFORMATION

TYPE - Specifically designed for installation in the 1951 Nash (Rambler Series cars only).

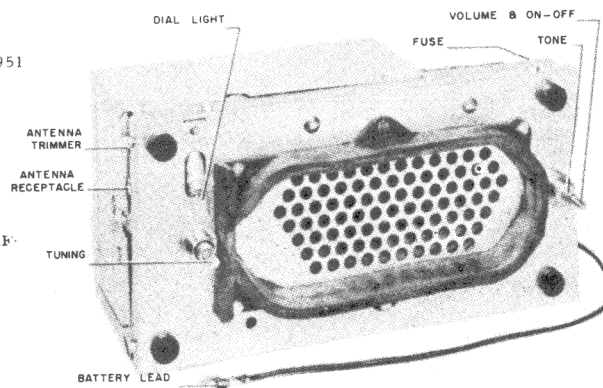
TUNING RANGE - 540 to 1600 Kc

IF FREQUENCY - 455 Kc

TUBE COMPLEMENT - 6BE6 - Converter
6BA6 - IF Amplifier
6AV6 - Detector, AVC & 1st AF Amplifier
6AS5 - Power Amplifier
6X4 - Rectifier

POWER INPUT - 5.0 amps at 6.3V DC

POWER OUTPUT - 2 watts (maximum)



OPERATING INSTRUCTION

VOLUME CONTROL & ON-OFF SWITCH. The volume control and on-off switch are combined and are operated with the inner right-hand knob. Turn radio on by turning knob to the right until a "click" is heard. Continued rotation to the right will increase volume. To turn radio off, turn knob fully to left until "click" is heard.

TONE CONTROL. The outer right-hand knob operates the tone control.

TUNING. Tune stations with the left-hand knob. Always tune carefully until you are exactly on the station; tuning to either side of it will result in poor tone quality.

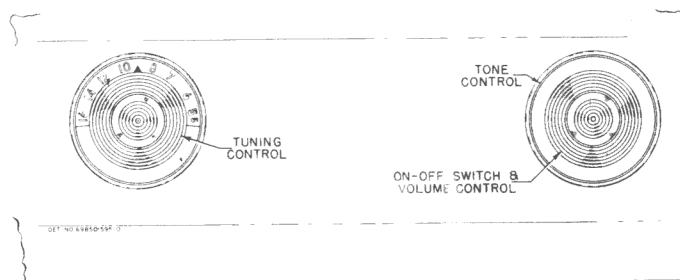


FIGURE 1. OPERATING CONTROLS

SERVICE NOTES

TO REPLACE TUBES. To replace tubes, it will be necessary to remove radio from car. Proceed as follows:

1. Disconnect "A" lead from car terminal located behind instrument panel.
2. Remove antenna plug from antenna receptacle located on left side of radio.
3. Pull off control knobs and pointer.
4. Remove two nuts, two washers and dial scale assembly.
5. Remove radio from behind instrument panel.
6. Remove large cover from radio to expose tubes.

RADIO NOISE SUPPRESSION. A capacitor installed on the car generator, a capacitor on the ignition coil, and a suppressor in the car's ignition system distributor circuit, eliminate motor noise from these sources.

TO REPLACE VIBRATOR OR FUSE. The plug-in type vibrator and radio fuse are accessible from the rear of the instrument panel. Should those require replacement, it is only necessary to pull out old vibrator or fuse and plug in a new one.

4545 AUGUSTA BOULEVARD

Motorola Inc.

CHICAGO 51, ILLINOIS

PART NO. 54P501598

(a)

Fig. 16-4

ALIGNMENT

EQUIPMENT REQUIRED

1. A small screwdriver for IF and RF alignment.
2. An accurately calibrated 400 cycle, AM modulated signal generator.
3. A low range output meter.
4. A special dummy antenna for RF alignment. Construct dummy antenna as shown in Figure 2.

PROCEDURE

1. All adjustments are accessible without removing the

covers, through holes provided.

2. Connect an output meter across the voice coil.

3. Connect a 6 volt storage battery to chassis and BATT terminal of receiver; turn receiver on and allow it to warm up for a few minutes.

4. For greatest accuracy, keep output of receiver at approximately 1/2 watt (1/2 watt = 1.25 volts on output meter) throughout alignment by reducing generator output (not receiver volume control) as stages are brought into alignment.

ALIGNMENT CHART

STEP	DUMMY ANTENNA	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SET TO	ADJUST	REMARKS
IF ALIGNMENT						
1.	.1 mf	Hi side -6BE6 grid (pin #7) Lo side-chassis	455 Kc	High freq. end	1, 2 3 & 4	Peak for maximum in order indicated. Check by repeating procedure.
RF ALIGNMENT						
2.	Special-see Figure 2	Ant receptacle through special dummy	1605 Kc	Gang open	5	Peak for maximum.
3.	"	"	1400 Kc	Tune in signal	6	Peak for maximum.
4.	"	"	600 Kc	"	7	Peak antenna padder for maximum while rocking gang.

5. Repeat steps 3 & 4 until maximum output is obtained. The last adjustment should be trimmer (6).

6. With set installed in car, peak antenna trimmer (6) for maximum noise or volume of a weak station. Car antenna should be fully extended.

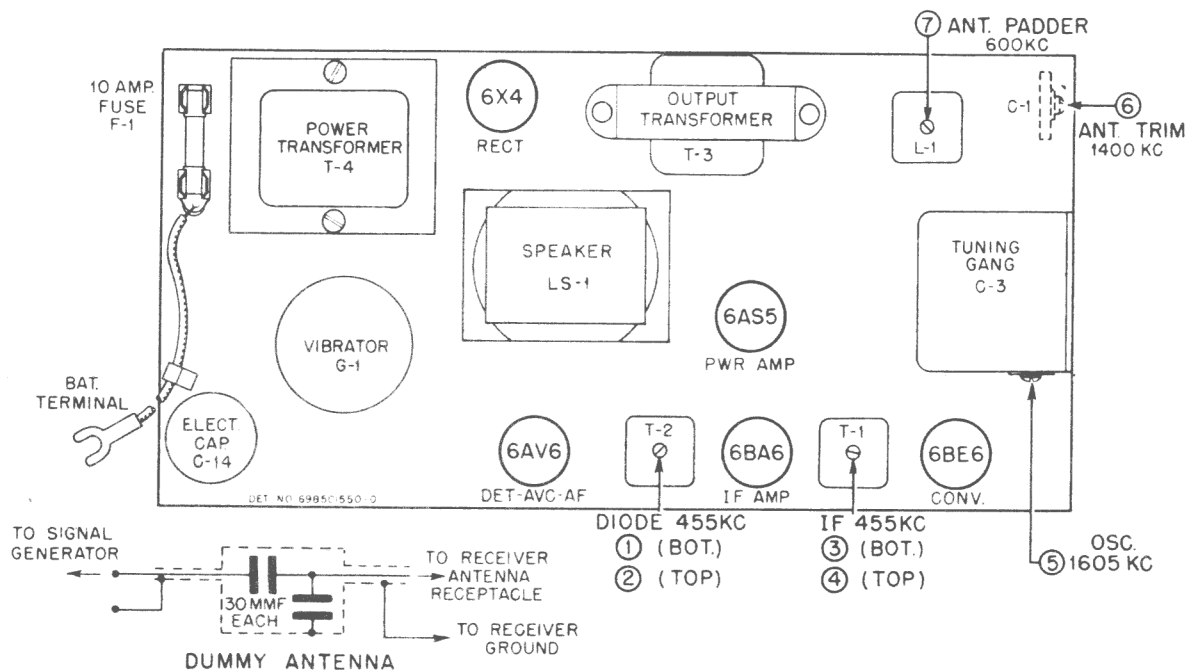


FIGURE 2. TUBE & TRIMMER LOCATION AND DUMMY

(b)

Fig. 16-4 (continued)



FREQUENCY RANGE = 540-1600KC

INPUT VOLTAGE WAS 6.3 VOLTS.
VOLTAGE TOLERANCE $\pm 10\%$.

(c)

Fig. 16-4 (continued)

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description	List Price	Ref. No.	Part Number	Description	List Price
CHASSIS PARTS - ELECTRICAL				Spark Plate			
Capacitors				SP-1	1A591512	Spark Plate Assembly	.30
C-1	20K481527	Trimmer, variable mica: 70 mmf; includes mounting brkt	.35	Transformers			
C-2	8R13514	Paper: .05 mf 100V	.20	T-1	24K591556	IF, 455 Kc: complete.....	1.00
C-3	19B501790	Variable, 2-gang	3.00	T-2	24K591555	Diode, 455 Kc: complete.....	1.45
C-4	8R4283	Paper: .25 mf 100V	.25	T-3	25B502142	Output Transformer	1.60
C-5	8R23146	Paper: .05 mf 200V	.20	T-4	25C591533	Power Transformer	3.25
C-6	8R4283	Paper: .25 mf 100V	.25				
C-7	8R592154	Paper: .03 mf 600V	.25	Part Number	Description	List Price	
C-8	8R472754	Paper: .01 mf 100V	.20	CHASSIS PARTS - MECHANICAL			
C-9	8K71910	Paper: .006 mf 400V	.20	1X591534	"A" Lead Assembly	.20	
C-10	8R51209	Paper: .02 mf 100V	.20	42A591508	Clamp, cable: cad pl (for "A" lead)	.15	
C-11	21R6543	Mica: 250 mmf 500V	.25	42A485548	Clip, coil can mtg (for T-1, T-2, & antenna coil).....doz	.20	
C-12	8R23053	Paper: .01 mf 200V	.20	42A4215	Clip, vibrator grounding.....doz	.75	
C-13	8R23690	Paper: .01 mf 400V	.20	4S7666	Lockwasher, ext: #6; cad pl (power transformer mtg)	.50	
C-14	23A500059	Electrolytic: 10 mf-10 mf 250V; 10 mf 25V	1.35	4S7655	Lockwasher, int: 3/8; cad pl (volume control mtg)	.50	
Fuse				2S1376	Nut, hex: 3/8-32 x 1/2; stl; cad pl (volume control mtg)	.50	
F-1	65A10266	Fuse: 10 amp	.05	2S7005	Nut, hex: 6-32 x 1/4; cad pl (power transformer mtg)	.50	
Vibrator				9A472148	Receptacle, antenna contact.....	.25	
G-1	48B3333	Vibrator: non-sync; 4-pin full wave	4.10	5S7771	Rivet: .088 x 3/16 stl; pol nkl (tube socket mtg).....per/c	.50	
Bulb				5S7707	Rivet: .122 x 5/32; stl; pol nkl (capacitor brkt mtg and spark plate mtg)	.50	
I-1	65X10867	Bulb: 6-8V; .25 amp; round; bayonet base; clear	.15	5S7701	Rivet: .122 x 3/16; stl; pol nkl (vibrator and output trans mtg)	.50	
Coils				5S7703	Rivet: .122 x 7/32; stl; pol nkl (fuse strip mtg)	.50	
L-1	24B591628	Antenna coil	1.05	3S7350	Screw, machine: 6-32 x 1/4; slotted hex head; locking type; cad pl (gang mtg)	.15	
L-2	24A591629	Oscillator coil	.80	3S7506	Screw, sheet metal: #6 x 1/4; PKZ; plain hex head; cad pl ("A" lead cable clamp mtg)	.50	
L-3	24A472535	Choke, hash	.40	9A70208	Socket, tube: 4-prong (for vibrator)	.20	
L-4	24K592197	Choke, antenna spark	.15	9A472534	Socket, tube: miniature; 7-prong...	.15	
Speaker				9K580218	Socket, tube: miniature; 8-prong (for power amplifier tube 6AS5)...	.15	
LS-1	50C501823	Speaker, PM: 4" x 6"; 3.2 ohm VC	3.85*	31A591516	Strip, fuse mtg	.15	
		exch	2.90	HOUSING PARTS & ACCESSORIES			
Resistors				35K591519	Bumper, grommet type: rubber; large (on front cover)	.05	
Note: All resistors are carbon, insulated type unless otherwise specified.				35K591518	Bumper, grommet type: rubber; small (on front cover)	.05	
R-1	6R6012	33,000 20% 1/2W	1.20	8A500108	Capacitor, noise suppression (ignition coil)	.75	
R-2	6R2035	82 10% 1/2W	1.20	8A500109	Capacitor, noise suppression (generator)	.75	
R-3	6R6004	1 meg 20% 1/2W	1.20	15D501838	Cover, rear.....	1.25	
R-4	6R6428	6800 10% 1/2W	1.20	1X502097	Cover Assembly, front: includes speaker, bushings and pilot light socket	5.50	
R-5	6R5614	56 10% 1/2W	1.20	32B501848	Gasket, speaker: rubber	.55	
R-6	6R5614	56 10% 1/2W	1.20				
R-7	18B501837	Volume Control: 250,000 ohms tapped at 25,000 ohms; includes on-off and tone control	2.10				
R-8	6R6394	12,000 10% 1/2W	1.20				
R-9	6R3987	6.8 meg 20% 1/2W	1.20				
R-10	-	Tone Control: 1 meg (part of volume control R-7).....	-				
R-11	6R6015	220,000 20% 1/2W	1.20				
R-12	6R6032	470,000 20% 1/2W	1.20				
R-13	6R6254	330 10% 1W	.20				
R-14	6R488313	3900 10% 1W N.I.	.20				
Switch							
S-1	-	Switch: part of volume control R-7					

*Plus Federal Excise Tax At Current Rate

(d)

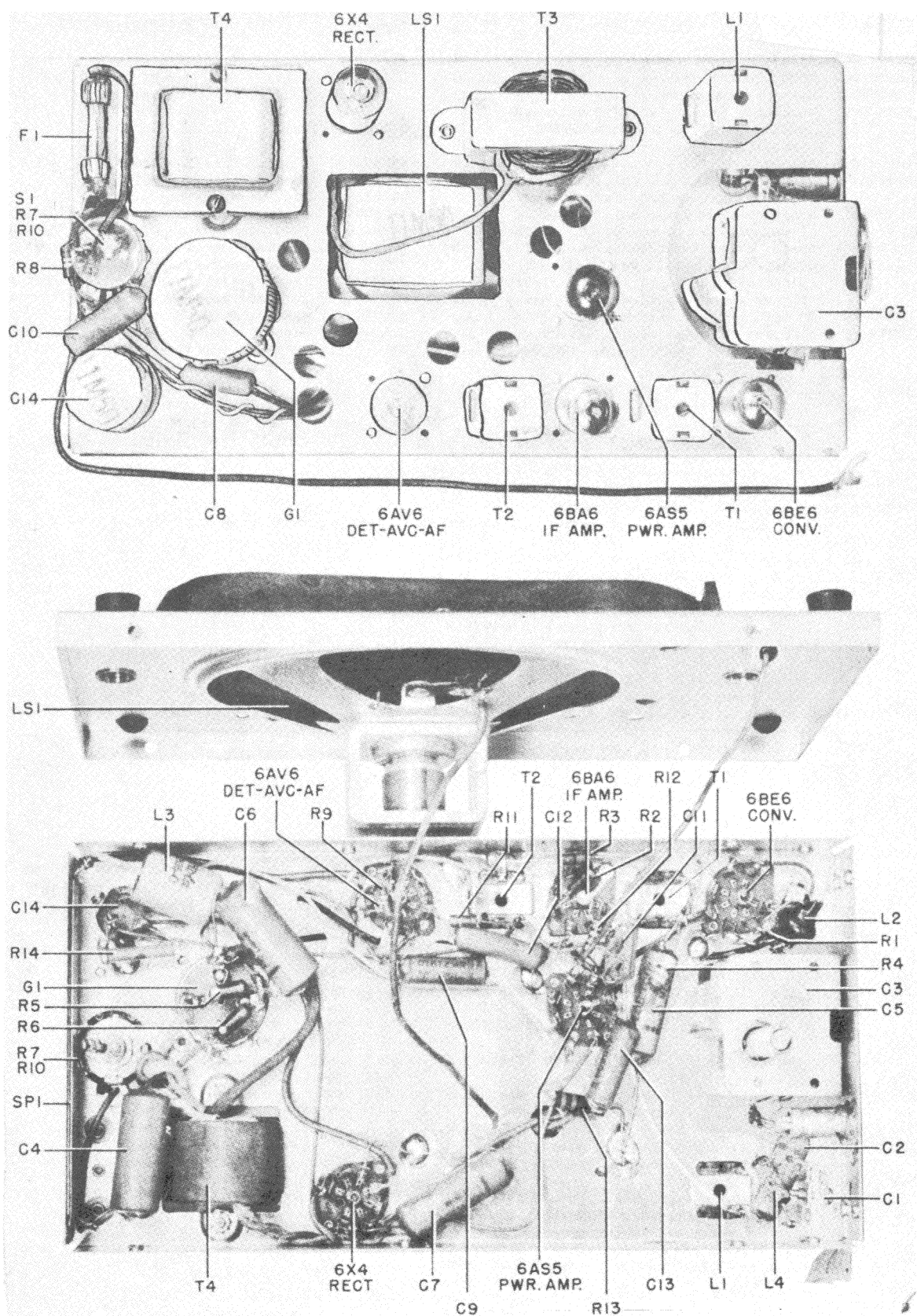
Fig. 16-4 (continued)

<u>Part Number</u>	<u>Description</u>	<u>List Price</u>	<u>Part Number</u>	<u>Description</u>	<u>List Price</u>
36B502202	Knob, tone control	.25	4S400868	Washer, flat: 3/4" x 19/32 x .042. thick; stl; cad pl (receiver mtg to instrument panel)doz	.15
36B502200	Knob, tuning control	.20			
36K502201	Knob, volume control	.25			
2A502084	Nut, hex: 9/16-24 x 11/16 stl; cad pl (receiver mtg to instrument panel)doz	.30	M-470C ANTENNA		
52A502203	Pointer, dial	.10	1B592409	Antenna Lead-In Assembly	1.40
5S7701	Rivet: .122 x 3/16; stl; nkl pl (pilot light socket mtg) ...per/c	.50	1B592622	Antenna Tube Assembly	1.40
5S490641	Rivet: .187 x 3/16; sti; nkl pl (spkr mtg)doz	.15	15A592617	Cap, antenna trim	.10
34C502204	Scale, dial: includes frame.....	.50	42K500171	Clip, speed	.20
3S7454	Screw, sheet metal: #8 x 1/4; PKZ plain hex head; stl; cad pl (front & back cover mtg)per/c	.50	14B592618	Insulator, antenna mtg tube.....	.10
9A502284	Socket, pilot light	.20	2S2884	Nut, hex: 5/16-32 x 1/2 x 3/16; brass; cad pl	.05
6A4141	Suppressor, noise	.25	4S490837	Washer, flat: 1-1/16 O.D. x .317 I.D. x .032 thick; stl; cad pldoz	.30
			4A592619	Washer, gasket	.05
			4K592453	Washer, rubber	.25

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

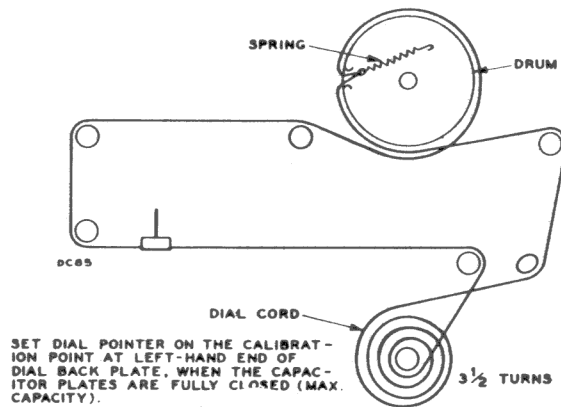
(e)

Fig. 16-4 (continued)



(f)

Fig. 16-4 (continued)



sons to follow will explain how to find all types of defects), a book of this type shows how other servicemen work and the methods that they use. You may improve on your own methods by reading about what other servicemen do. Also you learn about troubles that could occur with the models mentioned.

16-6. DIAL STRINGING BOOKLETS

A handy set of commercial booklets shows how to string dial cords and repair dial-drive and tuning systems. These booklets consist of drawings and other information taken from the original manufacturers' radio-data sheets. A portion of a radio manufacturers data sheet giving dial stringing information is shown in Fig. 16-5. Enough information is given to help you to make quick repairs on tuning dial systems. A later lesson will teach you how to make these repairs.

Since it is difficult to obtain data sheets for older models, these dial stringing book-

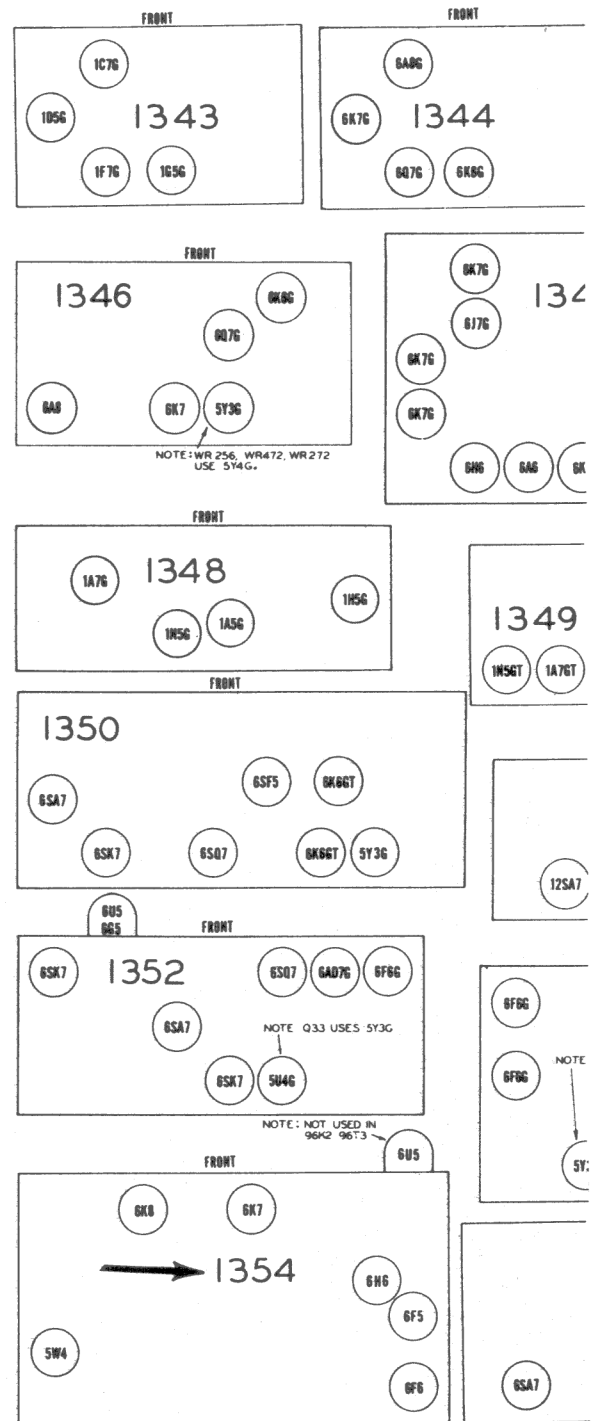
<i>Manufacturer</i>	<i>Diagram Number</i>
RCA VICTOR—Continued	
96T3	1354
96T4	1851
96T5	1851
96T6	1851
96T7	1315
96X1 to 96X4	1534
96X11 to 96X14	1534
97E	1354
97K	1315

(2)

lets are of great help. They may be bought either from your local radio parts distributor or directly from the publisher.

16-7. TUBE-REPLACEMENT GUIDE BOOKS

Tube-replacement guide books (Fig. 16-6) show the correct location for each of



(b)

Fig. 16-6

the radio tubes in a radio receiver. This information is very useful when a radio set having all of its tubes removed from the sockets is brought in for repair. If the sockets are not marked with the tube numbers, it is sometimes difficult to determine where each tube is to be correctly inserted. This information is shown in the service data sheet, but if the set is an old model and the data sheet can no longer be obtained, the information in this book will be of great value. A book on the market contains information for correct tube placement in hundreds of radio receivers made between 1938-1947

An index (Fig. 16-6a) allows the diagram page to be easily located. In the column headed with the manufacturer's name, find the model number of the set. For example, the RCA Victor 96T3 is shown in diagram 1354. The diagrams appear in numerical order in the book (Fig. 16-6b).

16-8. TUBE-SUBSTITUTION BOOK

A tube-substitution book is helpful when it becomes desirable or necessary to replace a tube in a radio receiver with a tube of a different type. Sometimes this has to be done either to improve the radio receiver or because the original tube is no longer made or is hard to get. For example, suppose that you were repairing a radio that was made in 1935. You found that a type 75 tube was defective and had to be replaced. It was found impossible to obtain a new 75 tube. The tube substitution book showed what to do in order to replace the 75 tube with a more modern type that does the same job. For example, a type 6Q7 tube is a more modern type than the type 75 and does the same job. In fact, the 6Q7 is actually a 75 tube having a different tube base. But this means that before the 6Q7 tube can be inserted, the 75 tube socket must be changed. That is, the old type six-prong socket used with the 75 tube must be removed, some wiring changes must be made, and the new eight-prong socket must be installed. Figure 16-7 shows the method used in the book to show you how to make the necessary changes in the receiver

when substituting one type of tube for another.

16-9. OBTAINING NEW PARTS NEEDED FOR RADIO RECEIVERS

When a radio part becomes defective, it should be replaced with a new one whenever possible. An exact duplicate of the part can usually be obtained from the manufacturer or the distributor of the radio set. A replacement part that will work just as well can also, in most cases, be obtained from the local radio-parts distributor. However, the local parts distributor may not carry the part in stock (for instance, a plastic cabinet); then it must be obtained from the distributor or the manufacturer or the receiver.

Ordering Replacement Parts from the Manufacturer or Distributor of the Receiver. Suppose that you were troubleshooting the a.c.-d.c. battery portable receiver model 3-BX-51 shown in Fig. 16-1a. You find that the ganged tuning capacitor has shorted plates that cannot be properly straightened and repaired. A new capacitor must be installed in place of the defective one. It is best to order this part direct from the manufacturer or distributor because it must correctly fit the mounting holes in the radio chassis, have the right value of capacitance, and work together with the tuning-dial drive in a correct manner.

The radio set or part usually is guaranteed for 90 days by the manufacturer; if the set or part has been owned for 90 days or less, always exchange the defective part for a new one with the set manufacturer or set distributor in order to avoid having to pay for the part.

If the set or part is over 90 days old, *first* go to the local radio parts distributor or check his Master Catalog (to be discussed later) and see if he has a replacement part that fits or that does the same job as the original defective part. If he does not have the correct part, *then* obtain it from the manufacturer or distributor. In any event, the part will have to be purchased and cannot be obtained free. In the case of the 3-BX-51 receiver, you might find that the parts distributor does not have the ganged tuning ca-

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RECEIVING TUBE SUBSTITUTION GUIDE

TUBE	SUB.	PERF.	CIRCUIT CHANGES NECESSARY
70L7	117L7	E	Remove line resistor cord and replace with straight AC cord. Reverse Nos. 4 and 5 Reverse 6 and 8
	117M7	E	
	117N7	E	Remove line cord resistor and replace with straight AC cord. Reverse Nos 4 and 5 No. 8 on No. 7 1 on 8
	117P7	E	
71A	482	G	No changes. If push-pull circuit, both tubes must be changed to avoid hum.
	483	G	
75	6AQ6	G	Same as 75 to 6AT6. Parallel circuits only.
	6AT6	G	Change socket to miniature and rewire as follows: No. 1 on six prong to No. 3 on miniature 2 to 7 3 to 5 4 to 6 5 to 2 6 to 4 cap to 1
	6AV6	G	
	6BF6	G	
	6BK6	G	
	6BT6	G	
	6BU6	G	
	6B6	E	Change socket to octal and rewire as follows: No. 1 on six prong to No. 2 on octal 2 to 3 3 to 4 4 to 5 5 to 8 6 to 7
	6Q7	E	
	6R7	G	

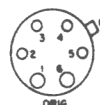
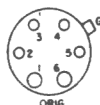


Fig. 16-7

pacitor that would fit the chassis. So, the part has to be ordered from the manufacturer or distributor of the receiver.

In order to order this part, first examine the schematic diagram as shown in Fig. 16-1c. The capacitor is marked C1-B. Next, refer to the Replacement Parts listing as shown in Fig. 16-1d and locate capacitor C1-B. It is located in the lefthand column at the top of the list. The Stock No. is 77957, which is the number to use when ordering the part from the distributor or manufacturer of the set.

If the radio receiver is manufactured in your town and the factory itself is close by, it probably will be possible to get the part directly from the set manufacturer. But if the factory is not close by, which is usually the case, you will have to get the part from the set distributor. The distributor's address can be obtained from a telephone directory or by asking a local retail radio dealer.

Obtaining Replacement Parts from the Radio Parts Distributor. In many instances, you will be able to get radio replacement parts from a radio-parts distributor, in your town or close by. These distributors stock most of the replacement parts needed for all types of radio receivers. For example, suppose that resistor R_4 in the a.c.-d.c. battery portable receiver was found to be defective. The schematic diagram of Fig. 16-1c shows this resistor to have a value of 22,000 ohms. The Replacement Parts list shown in Fig. 16-1d shows R_4 to have a tolerance of $\pm 10\%$ and have a rating of $1/2$ watt. It is not necessary to order this part from the radio-set distributor or manufacturer; the radio-parts distributor would most certainly have it in stock.

Let's consider another example. The volume control R_5 is found to be defective and must be replaced. The description column of the Replacement Parts listing shown in Fig. 16-1d indicates that it is a volume control and a power switch (on-off) combined in one unit. The schematic diagram gives its resistance value as one megohm. It is not necessary to

[illegible]

Fig. 16-8

order this part from the set manufacturer or distributor because you can get it much faster from a radio parts distributor. You should tell the parts distributor that you want a one-megohm *volume control*; not a one-megohm *potentiometer*. Although a volume control is a potentiometer, not all potentiometers are volume controls. This illustrates the value of briefly explaining how you want to use the part when you are not getting a duplicate replacement.

Master Parts Catalogs. It is easier to buy replacement parts from a radio parts distributor or manufacturer. A Master Parts Catalog will tell you which parts are available from the parts distributor and what the prices are. Such catalogs can be purchased for a few dollars from the radio-parts distributor or from the publisher of the catalog. The address of the publisher can be obtained from the parts distributor. The catalog contains hundreds of pages of parts buying information. Every important radio-parts man-

ufacturer is listed, and complete information is given about his product. The prices shown in the Master Catalog are list prices (top selling price). Most of the radio-parts distributors located in large cities usually charge less than the list price shown in the catalog. The same Master Catalog can be used as a reference when you buy from *any* radio parts distributor in any city or town.

Suppose that you found it necessary to replace capacitor C_5 , which is shown in Fig. 16-1c to have a capacitance of $0.047 \mu\text{f}$. This is called a screen-grid bypass capacitor. You can get this part from the radio-parts distributor. You can use the Master Catalog to select a capacitor that could substitute for the original one. First, locate the capacitor section in the capacitor section in the catalog, using the index in the back of the book. Next locate a replacement capacitor that is to take the place of C_5 . The Replacement Parts listing of Fig. 16-1d shows that the working voltage is 400 volts

d. c. A portion of a page taken from the capacitor section of a Master Catalog is shown in Fig. 16-8. Note that the catalog number, value in μf , d-c working voltage, and list price of each capacitor are shown. The capacitors referred to are tubular paper capacitors. A capacitor that could replace capacitor C_5 is listed as Catalog Number CP-3-403. It has a capacitance value of $0.047\mu\text{f}$ and the working voltage is rated 400 volts, which is the same as that of C_5 . When ordering this part from the parts distributor, catalog number CP-3-403 is used and not the factory number shown in Fig. 16-1d.

Most radio-parts distributors sell by mail as well as over the counter. However, some distributors will not bother to sell by mail unless the item sells for about \$10.00 or higher; other distributors will mail out less expensive items. The prices shown in the catalog change from year-to-year; if in doubt about the price or shipping charges, first write to the parts distributor before sending any money and ask for details.

Some radio-parts supply houses and parts distributors *specialize* in mail-order selling. They have mailing lists of radio and TV repairmen and technicians to whom they send mail-order sheets that give the description and prices of radio and TV replacement parts and supplies. Look for their advertisements in the radio and TV repair and service magazines. Write to them and request that your name be placed on their mailing lists.

16-10. MANUFACTURERS' PRODUCTION CODE

When repairing radio receivers, usually it will be easy to get information about circuits and replacement parts. In most cases, the radio manufacturer's name is printed or stamped on the radio chassis or cabinet. But this is not so if radio receivers are made by certain radio set manufacturers for large department stores or mail order houses. These stores may not want the set manufacturer's name to appear on the set but instead use the name of the store, as a brand name.

For example, suppose that Motorola, Inc., sold a large number of auto-radio receivers to the Chrysler Corporation. These receivers would be sold under the Chrysler brand name and installed in Chrysler cars. Now suppose that you were repairing one of these receivers and needed a replacement part, such as a power transformer, that had to be supplied by the radio-set manufacturer and which could not be purchased elsewhere. You can identify the set manufacturer by looking for the Manufacturer's Production Code number, which is usually rubber-stamped on the back of the chassis. The code is made up of a total of six digits. The first three digits identify the name of the set manufacturer. The last three numbers tell the date of manufacture. For example, if the first three digits were 260, this would indicate that the set was manufactured by let us say, the Philco Corporation, Philadelphia 34, Pa. There are over 900 different manufacturers and suppliers who use this code system, and each has his own code number. Most of these manufacturers belong to an association called RETMA or Radio-Electronics-Television Manufacturers Association, 777 14th St., N.W., Washington 5, D.C. To obtain a copy of the code book, write to that address. The code numbers are also stamped on certain parts in radio receivers. For example, if a radio part such as a transformer were rubber-stamped with the numbers 305421, you could learn who the transformer manufacturer is from the first three digits 305. The last three digits 421 indicate that the transformer was made during the week of May 16-22, 1954. This code has been in use since 1947.

Servicemen who have been in the business for a number of years find that they have accumulated a great deal of printed service information. It is important to store this information neatly so that it can be found easily when it is needed.

In addition to using available printed information, many servicemen keep records of their daily activities. Such records provide valuable service information. If a part is particularly difficult to get, make a record of what you did to get it. If a defect is hard to locate, write down what you did to find it.